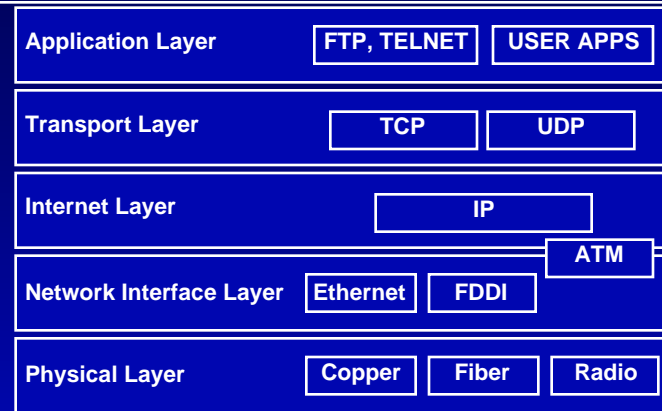


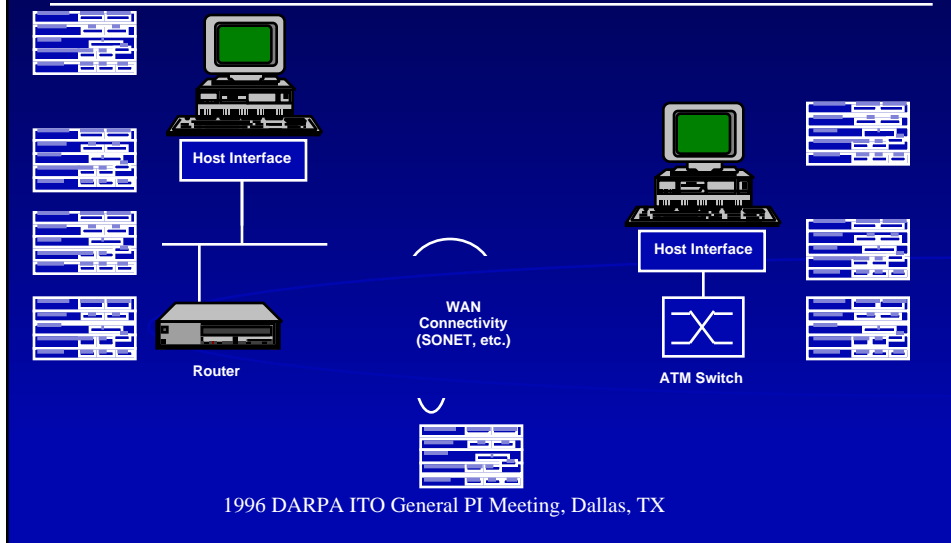
A Layered Look at QoS



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One method of organizing the network performance domain is to enlist the familiar layered model. In this case, I propose employing the nomenclature of the five-layer TCP/IP model, rather than the seven-layer ISO model, since so much of our infrastructure and environment is TCP/IP based. Either abstraction, though, could suffice for this exercise. By identifying the layers and subsequently cataloging types and attributes of components, interfaces, and systems into this framework, we may be able to more effectively identify likely bottlenecks as well as targets of opportunity for research and development/engineering improved performance into future products and infrastructure.

A Combined Approach - Layers + Topology



... characterized using the layer decomposition, as in the pure ATM scenario.

Problem Definition

- **Defining a QOS model from an system level, end-to-end perspective**
 - **group sessions, heterogeneous**
 - **dynamic environent**
- **Mechanisms for measuring and enforcing QOS**
- **Impact on QOS of adding new services**
- **Evolvability of QOS**

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Problem Definition

- **Impact of QOS requirements on network resources**
 - **provisioning services, dealing with resource limitations, global scheduling resources, balancing conflicting rqmts.**
 - **survivability -dealing with failures, attacks, degradations**

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Novel Approaches

- **Vocabulary development**
- **Protocols**
 - **QoS discovery**
 - **Dynamic, adaptive QoS**
- **Cost models for negotiating QoS**
- **QoS-based provisioning (short-term and long-term)**
- **QoS wrappers and proxies for legacy apps**

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Novel Approaches

- **QoS measurement**
 - Real-time evaluation
 - Algorithms for adjustment
- **Dynamic host resource allocation**
- **Application adaptation to QoS availability**
- **Complete disclosure of app's needs**
- **Network mechanisms for QoS**
 - Scheduling
 - Multiattribute routing

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Investment Strategy

- **On-going work**
 - **Evolving network capabilities**
 - **IETF int-serv working group**
 - **ATM Forum**

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Investment Strategy

- **Small scale efforts**
 - **Costing theory**
 - **Algorithmic representation of network state to users**
 - **Multi-level vocabulary to express QoS needs**

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Investment Strategy

- **Medium scale efforts**
 - **Dynamic negotiation - user testing**
- **Large scale efforts**
 - **QoS implementations (e.g., PSOS)**

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Down-side of Inaction

- QoS for audio, video only
- Conferencing with few players
- No bounded delay service for message-based traffic
- QoS not interoperable across diverse networks
- No QoS guarantees in dynamic environment
- Fault tolerant needs not met
- No QoS metrics

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